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Subjective health complaints predict functional outcome six months after stroke

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Objectives: Cerebrovascular stroke is a main cause of lasting disability in older age, and initial stroke severity has been established as a main determinant for the degree of functional loss. In this study, we searched for other predictors of functional outcome in a cohort of stroke patients participating in an early supported discharge randomised controlled trial.

Methods: Thirty candidate variables related either to premorbid history or to the acute stroke were examined by ordered logistic regression in 229 stroke patients. Dependent variables were modified Rankin Scale (mRS) at 6 months and mRS change from baseline to 6 months.

Results: For mRS at 6 months, Barthel Index at stable baseline post-stroke was the main predictor, with sex, age, previous cerebrovascular disease, previous peripheral artery disease and the necessity for tube feeding in the acute phase also contributing to the final model. For mRS change, only age and previous cerebrovascular disease were significant predictors. Prestroke subjective health complaints added significantly to all final models concurrently with sex losing its predictive power.

Conclusions: Initial stroke severity was the main predictor of functional outcome. Subjective health complaints score was a potent predictor for both outcome and improvement from baseline to 6 months and at the same time ameliorated the predictive impact of sex. The poorer functional prognosis for women after stroke may therefore be related to their higher load of subjective health complaints rather than to their sex itself. Treating these complaints may possibly improve the functional prognosis.

KEYWORDS

cerebrovascular diseases, rehabilitation, strokes, treatment

1 | INTRODUCTION

Cerebrovascular stroke is today the second most common cause of death and the third most common cause of disability-adjusted life years lost.[1] The number of patients living with disabilities following stroke must be expected to rise further in the future due to demographic changes with increasing number of aged people.[2] The degree of disability and reduced functional capacity after stroke is aetiologically multifactorial. The severity of the initial neurologic affection has been established as a main determinant, and some other variables as sex, age, previous cerebrovascular disease and previous peripheral artery disease are frequently reported to be important predictors,[3–9] but more specific knowledge about other possible predictive factors is needed in order to optimise stroke outcome.

We have recently conducted a randomised controlled trial (the ESD Stroke Bergen study) exploring the results of three different

rehabilitation schemes after stroke, where two of the randomisation groups were treated within the concept of early supported discharge (ESD) and one group which received treatment as usual served as controls.[10] The main results of this study have been published previously.[11] The aim of the present study was to identify possible predictors for (1) the patients' functional level 6 months after stroke (evaluated by mRS[12] at 6 months), and (2) the change in functional level from stable baseline (1 week post-stroke, or at discharge if discharged earlier) to 6 months after stroke (evaluated by change in mRS).

2 | PATIENTS AND METHODS

2.1 | Study design and patients

The ESD Stroke Bergen study recruited participants between 8 December 2008 and 20 December 2011, among patients admitted with confirmed acute cerebrovascular stroke (infarctions and cerebral haemorrhages, but excluding subarachnoid haemorrhage) to the stroke unit at the Department of Neurology, Haukeland University Hospital in Bergen, Norway.[10,11] The inclusion criteria for the study were wide, and the majority of acute stroke patients living in Bergen and admitted to the stroke unit were included, finally reaching 306 participants. The study was approved by the Western Norway Regional Committee for Medical Research Ethics.

Two hundred and twenty-nine of the 306 included patients were scored for the primary outcome mRS at 6 months, giving a follow-up rate of 74.8%. Main reasons for dropout were patients experiencing full recovery, being in a nursing home or not wanting to travel to the hospital for testing. These 229 patients constituted the study population in the present substudy, which thus has a prospective cohort design.

2.2 | Independent variables

Most baseline data were routinely collected during the stay in the stroke unit and prospectively registered in a database (the Bergen NORSTROKE Registry).[13] Some of the data (*randomisation group*, *subjective health complaints*, *Mini Mental State Examination [MMSE] score at baseline*)[14] were collected specifically as part of the ESD Stroke Bergen study. Altogether, this comprised demographic information, previous medical history and clinical information (examinations and scorings, treatment and complications) from the acute phase in the stroke unit. The data hence fell into two different categories: either related to the patient's life and medical history prior to stroke or to the stroke itself and the stay in the stroke unit. We selected 16 and 13 relevant variables considered to be of potential relevance for the functional outcome from each of these groups. In addition, we added the randomisation group in the main RCT study as a last variable, thereby ending up with 30 different possible predictors in the study.

Twenty of the variables were dichotomous, while some were ordinal (*previous smoking*, *estimated mRS before the stroke*, *Barthel Index at stable baseline*, *National Institutes of Health Stroke Scale [NIHSS] at stable baseline*), some continuous (*age*, *subjective health complaints* pre-stroke, *MMSE score at baseline*) and some categorical (*location of lesion*, *TOAST-classification*,[4] *randomisation group*).

NIHSS at stable baseline was scored according to a Norwegian 34-point version.[15]

Subjective health complaints was investigated using the Subjective Health Complaint Inventory described by Eriksen et al.[16] This inventory consists of 29 items concerning subjective somatic and psychological complaints experienced during the previous 30 days. Factor analysis has indicated five different inventory subscales: musculoskeletal pain (headache, neck pain, upper back pain, low back pain, arm pain, shoulder pain, migraine and leg pain during physical activity), pseudoneurology (extra heartbeats, heat flushes, sleep problems, tiredness, dizziness, anxiety and sadness/depression), gastrointestinal problems (heartburn, stomach discomfort, ulcer/non-ulcer dyspepsia, stomach pain, gas discomfort, diarrhoea and obstipation), allergy (asthma, breathing difficulties, eczema, allergy and chest pain) and flu (cold/flu and coughing).[16] The items are scored on a 4-point Likert scale (0–3; not at all/a little/some/serious). In this study, the period immediately before the stroke was explicitly defined as the report period and the scorings were obtained during the first week after admittance to the stroke unit. Patients with communication difficulties due to severe aphasia were not included in the subjective health complaints scoring.

Three of the variables (*subjective health complaints*, *estimated mRS before the stroke* and *MMSE score at baseline*) were introduced during the study period, leading to missing values for these variables in a certain number of the included patients.

2.3 | Dependent variables

Two different dependent variables were used in the study; mRS[12] 6 months after stroke and change in mRS from baseline to 6 months. mRS evaluates the patient's functional competency in seven levels (0–6) where scores from 0 to 2 signify independency, 3–5 varying degrees of dependency and 6 death of the patient. mRS change signifies the difference between 6 months and baseline values. mRS is a nonparametric ordinal variable, and mRS change was therefore considered likewise.

2.4 | Statistical analysis

Groups of patients completing the study and dropouts were compared for all selected variables using appropriate statistical tests (Pearson's exact chi-square test, *t*-test, Mann–Whitney *U*-test, Fisher's exact test). Significance level was set at 0.05 for all analyses.

Predictors for the outcomes mRS at 6 months and mRS change score from baseline to 6 months were explored by ordered logistic regression. All 30 variables were used in unadjusted regression. For the adjusted regression analyses, 24 of the 30 selected variables were used, leaving out six which were available only in a limited number of patients. Final models were elaborated by stepwise backward regression from the full model, leaving out the least significant predictor at

each step and finishing when all included variables added significantly to the model. *Age* and *sex* were by choice kept in all analyses, and the final models therefore contained these two variables in addition to remaining variables adding significantly to the model. The last six variables were finally added to the final models one at a time, to explore their possible effects. Also in the regression analyses, a significance level of 0.05 was set for all comparisons.

The statistical programme package Stata/SE 13.1 for Windows (StataCorp LP, College Station, TX, USA) was used for all data analyses.

3 | RESULTS

3.1 | Modified Rankin Scale scores and change scores

The mean (SD) mRS score at baseline for all 229 participants was 2.66 (1.23), whereas at 6 months, the mean score was 2.52 (1.50). Mean change score from baseline to 6 months was −0.15 (1.21).

3.2 | Analyses of predictors at baseline

Comparison of all 30 variables between the groups of patients completing the study and dropouts (30 comparisons) showed no significant differences except for *baseline total Barthel Index score* and *estimated mRS before the stroke* (Table 1). Mean Barthel score was higher (better) in the dropouts (83.4) vs patients completing the study (75.3) (P=.008). However, patients who died between baseline and 6 months (n=16) were included among the completers (with a mRS=6), and excluding them from the analyses reduced the difference to 83.4 vs 78.3 (P=.038). Also, estimated prestroke mRS was better in the dropouts compared to completers (P=.037).

3.3 | Analyses of predictors for mRS at 6 months

The results of the regression analyses for mRS at 6 months are given in Table 2, providing unadjusted results for all 30 variables, fully adjusted results for the 24 variables with only a few (0 to 6) missing observations, as well as the final model after stepwise backward regression. In the unadjusted model, many variables were significant predictors, but in the fully adjusted model only *sex*, *Barthel Index at stable baseline* and *tube feeding necessary in acute phase* were. In the final model *sex*, *age*, *previous cerebrovascular disease*, *previous peripheral artery disease*, *Barthel Index at stable baseline* and *tube feeding necessary in acute phase* were significant predictors for mRS at 6 months.

3.4 | Analyses of predictors for mRS change from stable baseline to 6 months

The same procedure was repeated with mRS change score from stable baseline to 6 months as dependent variable. Unadjusted regression (Table 3) showed significance for eight variables (*sex*, *age*, *previous cerebrovascular disease*, *previous peripheral artery disease*, *tube feeding necessary in acute phase*, *leukoaraiosis on CT or MRI*, *subjective health complaints* and *estimated mRS before the stroke*), whereas in the fully adjusted model only two (*sex* and *tube feeding necessary in acute phase*) were significant predictors. In the final model, *sex* and *previous cerebrovascular disease* showed as significant negative predictors.

3.5 | Subjective health complaints as predictor for mRS at 6 months and mRS change from stable baseline to 6 months

The variable *subjective health complaints* was registered in a limited number of the patients and was therefore not included in the fully adjusted and final regression models. As *subjective health complaints*, however, was a highly significant predictor in all unadjusted analyses, the effect of this variable was explored by adding it to the final models elaborated. The findings are given in Table 4.

The predictive power of *subjective health complaints* was retained in both modified final models, at about the same significance level as in the unadjusted analyses. Concurrently, the predictive power of *sex* was completely eliminated. Post hoc we therefore also analysed *subjective health complaints* in men and women separately and found a significantly higher score in women than in men (0.44 vs 0.28, P=.005). In addition, all variables were compared between the patient groups with (n=121) and without (n=108) obtained *subjective health complaints* score to detect possible discrepancies between them. We found no statistically significant differences except for urinary incontinence which was more common in patients without *subjective health complaints* scored (P=.024).

4 | DISCUSSION

Potential predictors for functional outcome 6 months after acute stroke have been systematically analysed using ordered logistic regression in 229 patients, recruited as participants in a randomised controlled trial comparing different rehabilitation schemes. The original patient cohort comprised 306 patients, but 77 of these dropped out before the 6 month scoring of the dependent variable mRS. Comparison of the completers and the drop-outs showed no definite difference except for a better function evaluated by Barthel Index in the dropouts, but this was to a large extent caused by patients dying before 6 months being included among completers. We therefore consider our results to be generalizable to the full stroke cohort.

As could be expected, the strongest predictor for absolute functional level at 6 months was the patients' functional level at stable baseline, expressed by Barthel Index score. Previous cerebrovascular disease and peripheral artery disease were significant negative predictors. Patients needing tube feeding obviously constitute a group with low general function, explaining the negative prediction.

TABLE 1 Premorbid and stroke-related variables in 306 ESD Stroke Bergen study patients; all patients and split between 229 completers and 77 dropouts

Variable	All patients (N=306)	Completers (n=229)	Dropouts (n=77)	*P*-value[a]
Premorbid variables:				
Sex; males/females (% male)	169/137 (55.2)	122/107 (53.3)	47/30 (61.0)	.236
Age, years; mean	72.24	72.19	72.39	.910
Previous cerebrovascular disease; yes/no (% yes)*	62/238 (20.8)	44/181 (19.6)	18/57 (24.0)	.410
Previous coronary disease; yes/no (% yes)	71/235 (23.2)	55/174 (24.0)	16/61 (20.8)	.560
Previous peripheral artery disease; yes/no (% yes)	20/286 (6.5)	13/216 (5.7)	7/70 (9.1)	.294
Previous hypertension; yes/no (% yes)	177/129 (57.8)	132/97 (57.6)	45/32 (58.4)	.902
Previous diabetes; yes/no (% yes)*	46/258 (15.1)	32/196 (14.0)	14/62 (18.4)	.355
Previous atrial fibrillation, paroxystic; yes/no (% yes)	29/277 (9.5)	21/208 (9.2)	8/69 (10.4)	.752
Previous atrial fibrillation, chronic; yes/no (% yes)	27/279 (8.8)	19/210 (8.3)	8/69 (10.4)	.575
Previous smoking; never/previous/current*	128/102/65	97/82/44	31/20/21	.436
Living with partner; yes/no (% yes)	169/137 (55.2)	129/100 (56.3)	40/37 (51.9)	.503
In work before the stroke; yes/no (% yes)*	63/242 (20.7)	48/181 (21.0)	15/61 (19.7)	.819
Subjective health complaints prestroke; mean item score[#]*	0.37	0.36	0.40	.479
Estimated mRS before the stroke; 0/1/2/3/4*	150/8/21/9/1	111/7/19/8/1	39/1/2/1/0	**.037**
Previous migraine; yes/no (% yes)*	49/186 (20.9)	42/137 (23.5)	7/49 (12.5)	.078
Previous depression, yes/no (% yes)*	48/190 (20.2)	34/144 (19.1)	14/46 (23.3)	.480
Stroke-related variables:				
Barthel Index at stable baseline; mean*	77.3	75.3	83.4	**.008**
NIHSS at stable baseline; mean*	4.0	4.2	3.3	.228
Type of stroke; infarction/haemorrhage (% infarction)	270/36 (88.2)	202/27 (88.2)	68/9 (88.3)	.981
Thrombolysis performed; yes/no (% yes)	44/262 (14.4)	35/194 (15.3)	9/68 (11.7)	.437
Tube feeding necessary in acute phase; yes/no (% yes)	26/280 (8.5)	23/206 (10.0)	3/74 (3.9)	.094
Urinary retention in acute phase; yes/no (% yes)	105/201 (34.3)	82/147 (35.8)	23/54 (29.9)	.342
Urinary incontinence in acute phase; yes/no (% yes)	57/249 (18.6)	48/181 (21.0)	9/68 (11.7)	.071
Pneumonia in acute phase; yes/no (% yes)	34/272 (11.1)	29/200 (12.7)	5/72 (6.5)	.136
Urinary tract infection in acute phase; yes/no (% yes)	41/265 (13.4)	32/197 (14.0)	9/68 (11.7)	.611
Leukoaraiosis on CT or MRI; yes/no (% yes)	159/147 (52.0)	123/106 (53.7)	36/41 (46.8)	.290
Location of lesion; n (%)				.678
Lacunar syndrome	75 (24.5)	57 (24.9)	18 (23.4)	
Total anterior circulation syndrome	37 (12.1)	30 (13.1)	7 (9.1)	
Partial anterior circulation syndrome	130 (42.5)	97 (42.4)	33 (42.9)	
Posterior circulation syndrome	64 (20.9)	45 (19.7)	19 (24.7)	
TOAST-classification (infarctions only); n (%)				.253
Atherosclerosis	28 (10.4)	22 (10.9)	6 (8.8)	
Cardiac embolic	99 (36.7)	69 (34.2)	30 (44.1)	
Microangiopathy	38 (14.1)	30 (14.9)	8 (11.8)	
Others	3 (1.1)	1 (0.5)	2 (2.9)	
Unknown	102 (37.8)	80 (39.6)	22 (32.4)	
MMSE score at baseline; mean*	23.7	24.0	22.5	.205
Randomisation group; n (%)				.075
Day unit treatment	103 (33.7)	81 (35.4)	22 (28.6)	
Home treatment	104 (34.0)	82 (35.8)	22 (28.6)	
Control	99 (32.4)	66 (28.8)	33 (42.9)	

ESD, early supported discharge; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; CT, Computerised Tomography; MR, Magnetic Resonance Imaging; TOAST, Trial of Org 10172 in Acute Stroke Treatment[4]; MMSE, Mini Mental State Examination.

[a]Comparison between completers and dropouts, statistical tests: χ^2-test, *t*-test, Mann–Whitney *U*-test or Fisher's exact test as appropriate; *some data are missing; [#]Likert scale 0–3. *P*-values ≤.05 indicated in bold.

The variables studied were selected from availability and clinical purposefulness. Variables with more than six missing observations were not included in the fully adjusted analyses and primary final models to keep a high number of patients as basis for the results. Some of these variables were significant predictors in the unadjusted analyses, but only one of them (subjective health complaints) remained a highly significant predictor also when added to the elaborated final models.

As mRS change from baseline to 6 months constitutes the degree of functional improvement or deterioration after acute stroke, significant predictors signify a definite influence on the patient's degree of recovery after the stroke. Such predictors were much sparser than predictors for the absolute functional level after stroke, but tube feeding in the acute phase was consistently a significant negative predictor also for this outcome. Barthel Index in the stable acute phase had no

TABLE 2 Unadjusted, fully adjusted and final models after ordered logistic regression of mRS at 6 months of potential predictors in 229 ESD Stroke Bergen study patients

	Unadjusted model				Fully adjusted model (n=214)			Final model (n=223)		
Predictor	n	OR	95% CI	*P*-value	OR	95% CI	LR test *P*-value	OR	95% CI	LR test *P*-value
Premorbid variables:										
Sex (female vs male)	229	2.00	(1.25, 3.20)	**.004**	2.28	(1.27, 4.09)	**.006**	2.04	(1.23, 3.39)	**.006**
Age per 10 years	229	1.71	(1.40, 2.09)	**<.001**	1.33	(0.94, 1.88)	.103	1.32	(1.06, 1.64)	**.012**
Previous cerebrovascular disease	225	2.27	(1.25, 4.13)	**.007**	1.82	(0.85, 3.90)	.124	2.24	(1.20, 4.16)	**.011**
Previous coronary disease	229	1.22	(0.72, 2.08)	.454	1.21	(0.61, 2.40)	.577			
Previous peripheral artery disease	229	3.64	(1.08, 12.3)	**.037**	3.06	(0.80, 11.73)	.100	5.89	(1.73, 20.00)	**.004**
Previous hypertension	229	1.92	(1.20, 3.08)	**.007**	1.18	(0.66, 2.09)	.578			
Previous diabetes	228	1.40	(0.73, 2.70)	.313	1.14	(0.48, 2.72)	.765			
Previous atrial fibrillation, paroxystic	229	1.24	(0.56, 2.74)	.597	0.43	(0.16, 1.12)	.084			
Previous atrial fibrillation, chronic	229	2.27	(0.89, 5.74)	.085	1.97	(0.57, 6.84)	.285			
Previous smoking	223	1.02	(0.75, 1.39)	.903	1.27	(0.87, 1.86)	.215			
Living with partner	229	0.57	(0.36, 0.92)	**.021**	0.80	(0.44, 1.43)	.447			
In work before the stroke	229	0.30	(0.17, 0.52)	**<.001**	1.30	(0.55, 3.08)	.549			
Stroke-related variables:										
Barthel Index at stable baseline per 5 points	227	0.74	(0.70, 0.78)	**<.001**	0.78	(0.70, 0.85)	**<.001**	0.76	(0.71, 0.81)	<.001
NIHSS at stable baseline	227	1.28	(1.20, 1.36)	**<.001**	1.11	(0.98, 1.26)	.094			
Haemorrhage vs infarction	229	1.26	(0.87, 1.84)	.227	0.89	(0.56, 1.42)	.627			
Thrombolysis performed	229	0.95	(0.50, 1.82)	.883	0.54	(0.25, 1.15)	0.108			
Tube feeding necessary in acute phase	229	16.4	(6.91, 39.0)	**<.001**	3.81	(1.10, 13.17)	**.032**	2.61	(1.02, 6.72)	.044
Urinary retention in acute phase	229	2.10	(1.29, 3.43)	**.003**	0.78	(0.42, 1.44)	.423			
Urinary incontinence in acute phase	229	6.53	(3.54, 12.1)	**<.001**	1.03	(0.48, 2.25)	.933			
Pneumonia in acute phase	229	8.53	(4.07, 17.9)	**<.001**	2.02	(0.73, 5.61)	.176			
Urinary tract infection in acute phase	229	3.80	(1.95, 7.37)	**<.001**	1.68	(0.71, 3.96)	.237			
Leukoaraiosis on CT or MRI	229	2.61	(1.62, 4.21)	**<.001**	1.82	(0.97, 3.40)	.061			
Location of lesion	229			**<.001**			.055			
Lacunar syndrome	57	0.18	(0.08, 0.41)	**<.001**	1.58	(0.49, 5.07)				
Total anterior circulation syndrome	30	1	(reference)		1	(reference)				
Partial anterior circulation syndrome	97	0.25	(0.12, 0.51)	**<.001**	3.22	(1.04, 9.98)				
Posterior circulation syndrome	45	0.18	(0.08, 0.43)	**<.001**	3.33	(0.95, 11.6)				
Randomisation group	229			.408			.137			
Day unit treatment	81	0.69	(0.38, 1.23)	.204	0.51	(0.25, 1.02)				
Home treatment	82	0.73	(0.41, 1.30)	.291	0.80	(0.40, 1.59)				
Control	66	1	(reference)		1	(reference)				
TOAST classification (infarctions only)	202			.073						
Atherosclerosis	22	0.81	(0.35, 1.92)	.639						
Cardiac embolic	69	1	(reference)							
Microangiopathy	30	0.32	(0.14, 0.70)	**.004**						
Others	1	0.44	(0.02, 8.27)	.586						
Unknown	80	0.68	(0.38, 1.22)	.197						

(Continues)

TABLE 2 (Continued)

	Unadjusted model				Fully adjusted model (n=214)			Final model (n=223)		
Predictor	n	OR	95% CI	*P*-value	OR	95% CI	LR test *P*-value	OR	95% CI	LR test *P*-value
Subjective health complaints	121	5.25	(1.77, 15.55)	**.003**						
Estimated mRS before the stroke	146	2.37	(1.72, 3.27)	**<.001**						
Previous migraine	179	0.60	(0.33, 1.11)	.102						
Previous depression	178	1.08	(0.55, 2.09)	.825						
MMSE score at baseline	104	0.87	(0.81, 0.93)	**<.001**						

ESD, early supported discharge; mRS, modified Rankin Scale; OR, Odds Ratio; CI, Confidence Interval; LR-test, Likelihood ratio test; NIHSS, National Institutes of Health Stroke Scale; CT, Computerised Tomography; MRI, Magnetic Resonance Imaging; TOAST, Trial of Org 10172 in Acute Stroke Treatment[4]; MMSE, Mini Mental State Examination. *P*-values ≤.05 indicated in bold.

TABLE 3 Unadjusted, fully adjusted and final models after ordered logistic regression of mRS change from baseline to 6 months of potential predictors in 229 ESD Stroke Bergen study patients

	Unadjusted model				Fully adjusted model (n=214)			Final model (n=225)		
Predictor	n	OR	95% CI	*P*-value	OR	95% CI	LR test *P*-value	OR	95% CI	LR-test *P*-value
Premorbid variables:										
Sex (female vs male)	229	1.79	(1.11, 2.88)	**.016**	2.09	(1.17, 3.74)	**.013**	1.69	(1.03, 2.76)	**.037**
Age per 10 years	229	1.26	(1.04, 1.52)	**.016**	1.30	(0.94, 1.82)	.117	1.19	(0.08, 1.45)	.080
Previous cerebrovascular disease	225	2.45	(1.35, 4.45)	**.003**	2.03	(0.97, 4.27)	.060	2.39	(1.31, 4.38)	**.005**
Previous coronary disease	229	1.44	(0.83, 2.51)	.193	1.77	(0.91, 3.43)	.091			
Previous peripheral artery disease	229	3.29	(1.15, 9.37)	**.026**	1.88	(0.57, 6.24)	.305			
Previous hypertension	229	1.42	(0.88, 2.29)	.147	1.33	(0.75, 2.33)	.328			
Previous diabetes	228	1.00	(0.50, 1.98)	.989	0.66	(0.28, 1.53)	.333			
Previous atrial fibrillation, paroxystic	229	0.70	(0.31, 1.62)	.410	0.42	(0.16, 1.10)	.076			
Previous atrial fibrillation, chronic	229	2.31	(0.96, 5.60)	.063	2.20	(0.73, 6.66)	.163			
Previous smoking	223	1.08	(0.79, 1.48)	.637	1.33	(0.91, 1.95)	.142			
Living with partner	229	0.76	(0.47, 1.21)	.246	0.92	(0.53, 1.62)	.785			
In work before the stroke	229	0.72	(0.41, 1.26)	.246	1.65	(0.70, 3.90)	.250			
Stroke-related variables:										
Barthel Index at stable baseline per 5 points	227	1.00	(0.96, 1.04)	.927	1.05	(0.97, 1.14)	.255			
NIHSS at stable baseline	227	0.98	(0.93, 1.03)	.428	1.01	(0.90, 1.14)	.819			
Haemorrhage vs infarction	229	0.75	(0.51, 1.11)	.147	0.78	(0.50, 1.21)	.259			
Thrombolysis performed	229	0.61	(0.32, 1.19)	.146	0.73	(0.34, 1.59)	.433			
Tube feeding necessary in acute phase	229	2.67	(1.21, 5.89)	**.015**	4.60	(1.53, 13.82)	**.007**			
Urinary retention in acute phase	229	0.73	(0.45, 1.19)	.203	0.69	(0.37, 1.27)	.233			
Urinary incontinence in acute phase	229	1.03	(0.59, 1.80)	.927	1.05	(0.51, 2.15)	.898			
Pneumonia in acute phase	229	1.61	(0.78, 3.32)	.201	2.31	(0.87, 6.14)	.093			
Urinary tract infection in acute phase	229	1.22	(0.64, 2.32)	.547	1.15	(0.51, 2.60)	.737			
Leukoaraiosis on CT or MRI	229	1.66	(1.03, 2.68)	**.036**	1.17	(0.64, 2.14)	.611			
Location of lesion	229			.342			.164			
Lacunar syndrome	57	1.24	(0.55, 2.81)	.606	1.51	(0.49, 4.63)				

(Continues)

TABLE 3 (Continued)

	Unadjusted model				Fully adjusted model (n=214)			Final model (n=225)		
Predictor	n	OR	95% CI	*P*-value	OR	95% CI	LR test *P*-value	OR	95% CI	LR-test *P*-value
Total anterior circulation syndrome	30	1	(reference)		1	(reference)				
Partial anterior circulation syndrome	97	1.80	(0.85, 3.82)	.127	2.62	(0.88, 7.73)				
Posterior circulation syndrome	45	1.76	(0.75, 4.13)	.196	2.82	(0.85, 9.36)				
Randomisation group	229			.523			.409			
Day unit treatment	81	0.83	(0.46, 1.48)	.523	0.67	(0.35, 1.31)				
Home treatment	82	0.71	(0.39, 1.28)	.257	0.66	(0.33, 1.30)				
Control	66	1	(reference)		1	(reference)				
TOAST-classification (infarctions only)	202			.517						
Atherosclerosis	22	0.86	(0.36, 2.06)	.728						
Cardiac embolic	69	1	(reference)							
Microangiopathy	30	0.52	(0.24, 1.14)	.102						
Others	1	1.15	(0.05, 25.6)	.930						
Unknown	80	0.99	(0.55, 1.79)	.980						
Subjective health complaints	121	10.19	(3.10, 33.48)	**<.001**						
Estimated mRS before the stroke	146	1.55	(1.13, 2.11)	**.006**						
Previous migraine	179	0.70	(0.38, 1.29)	.250						
Previous depression	178	1.18	(0.62, 2.27)	.611						
MMSE score at baseline	104	0.98	(0.92, 1.05)	.624						

ESD, Early Supported Discharge; mRS, modified Rankin Scale; OR, Odds Ratio; CI, Confidence Interval; LR-test, Likelihood ratio test; NIHSS, National Institutes of Health Stroke Scale; CT, Computerised Tomography; MRI, Magnetic Resonance Imaging; TOAST, Trial of Org 10172 in Acute Stroke Treatment[4]; MMSE, Mini Mental State Examination. *P*-values ≤.05 indicated in bold.

significant influence on the patients' improvement or deterioration, and neither had randomisation group in the ESD study.

The variables estimated mRS before the stroke (but retrospectively evaluated afterwards), subjective health complaints (also before the stroke, but scored shortly after the stroke) as well as MMSE were not collected from the beginning of the study and the number of observations is therefore markedly lower than for the other variables. They were significant predictors in the unadjusted analyses, but not included in the adjusted analyses as described above.

To explore their effects, these variables were added to the final models. Previous mRS and MMSE showed some significance, but this was not pursued further in this study. The by far strongest of the three variables was subjective health complaints score, being a strong predictor both for absolute functional level at 6 months (*P*=.003) and mRS change from baseline to 6 months (*P*<.001). To examine the generalizability of these findings to the total patient group, we compared the other variables between the patients groups with and without subjective health complaints score obtained and found no difference between them. This indicates that the findings regarding subjective health complaints are generalizable to the full study patient group. The degree of reported subjective health complaints thus seems to be an important determinant for both improvement and functional level 6 months after stroke.

Subjective health complaints have previously been reported to be frequent in patients with low back pain, thereby alluding to the psychosomatic aspect of this condition.[17] On a more general basis, a high level of subjective health complaints signifies increased risk of long term sickness absence from work.[18]

For reasons of principle, we included the variables sex and age in all analyses, but the results regarding these predictors were somewhat conflicting and difficult to interpret. A basic question, especially concerning age, is whether the apparent associations are due to ageing itself or secondary to other causes. Regarding sex, previous researchers have generally reported a negative effect of female sex on functional outcome.[5,19–27] This is seen also in the present study (for details, see[11]). However, when corrected for subjective health complaints, the predictive value of sex disappeared completely, as seen in Table 4. In our study, subjective health complaints also are much more common in females than in males, and the poorer functional prognosis in females may therefore be related to their degree of subjective health complaints rather than to their sex alone. The women in our study were on average 6 years older than the males,[11] but the significant relationship between subjective health complaints and functional outcome still holds adjusted for age (results not shown).

This relationship between subjective health complaints and functional outcome after stroke has to our knowledge neither been

TABLE 4 Subjective health complaints as predictor for mRS at 6 months and mRS change from baseline to 6 months. Results of univariate analyses and when added to the final multivariate models shown in Tables 2 and 3.

Predictor	OR	95% CI	*P*-value
Univariate analysis (n=121)			
mRS 6 months			
Subjective health complaints	5.25	(1.77, 15.55)	**.003**
mRS change score			
Subjective health complaints	10.19	(3.10, 33.48)	**<.001**
Multivariate analysis (n=118)			
mRS 6 months			
Sex (female vs male)	1.23	(0.59, 2.55)	.577
Age per 10 years	1.76	(1.29, 2.41)	**<.001**
Previous cerebrovascular disease	2.09	(0.82, 5.31)	.120
Previous peripheral artery disease	11.45	(1.51, 86.74)	**.016**
Barthel Index at stable baseline per 5 points	0.77	(0.71, 0.84)	**<.001**
Tube feeding necessary in acute phase	5.65	(1.18, 26.96)	**.028**
Subjective health complaints	5.83	(1.78, 19.14)	**.004**
mRS change score			
Sex (female vs male)	1.35	(0.65, 2.77)	.420
Age per 10 years	1.44	(1.08, 1.90)	**.012**
Previous cerebrovascular disease	2.29	(0.92, 5.67)	.074
Subjective health complaints	10.02	(2.88, 34.90)	**<.001**

mRS, modified Rankin Scale; OR, Odds Ratio; CI, Confidence Interval. *P*-values ≤ .05 indicated in bold.

examined nor reported before, and we suggest that a higher burden of subjective health complaints may be a contributing explanation for the frequent finding of worse functional prognosis after stroke in women than in men.

Possible predictive factors for the functional outcome after stroke have been investigated in many previous studies.[3–9,28,29] The most dominant finding is that the severity of neurological or functional disability immediately after the stroke has a major influence.[3–9,28,29] This has been demonstrated universally and it is also a main finding in our study. In addition higher age,[3,5,8,9] female sex,[5,19,21–27] prior cerebrovascular disease,[3,5,8] peripheral artery disease,[7] arm paresis,[5] diabetes,[5,7] fever,[5] TOAST-classification [4,28] and infarct location,[5,6,28] among others, have been reported to be negative predictors. The main results in our study thus are consistent with previous findings, emphasising especially stroke severity and prior cerebrovascular disease in addition to age and sex. The sex effect has by others been suggested to be secondary to other factors,[20,22,24] and this is supported by our findings concerning subjective health complaints.

Factors predicting the degree of functional improvement from stable baseline to 6 months (mRS change score) were quite sparse in the present study. Only higher age and the amount of reported subjective health complaints were statistically significant in the final models, and subjective health complaints was by far the stronger predictor of the two. Unlike most other predictors subjective health complaints may be accessible for treatment and modification in the rehabilitation period, for example by cognitive therapy or education in more simple coping strategies, and this might contribute to a better functional outcome.

Depression might conceivably be one explanation for subjective health complaints being a negative predictor. Depression is however only one of 29 items of the Subjective Health Complaints Inventory and hence contributes only very modestly to the score. In addition, depression was one of the 30 independent variables explored in the study, but without significance in the univariate analyses.

The prospective design may be considered a strength of the study, whereas the number of missing data for some variables is an obvious limitation. The patients scored for these variables were however selected only by their late recruitment to the study, and they should therefore be expected to constitute a random sample of the total study population. This assumption was confirmed by the comparative analysis.

In conclusion, the present study supports the previous general finding of stroke severity being a main predictor for post-stroke function. It also lends support to sex, age, previous cerebrovascular and peripheral artery disease as well as tube feeding in the acute phase as negative predictors. Importantly, however, the degree of prestroke subjective health complaints was found to be a potent negative predictor for functional outcome in general and possibly a main explanation for the worse functional prognosis in female stroke patients. This predictor should be taken into account in future intervention studies and in the rehabilitation of stroke patients.

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CONFLICT OF INTERESTS

The authors declare that they have no financial or non-financial competing interests.

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